

WHAT IS CLAIMED IS:

1. An image processing method for determining a conversion relationship by using patches, the conversion relationship relating to a generation of color material data for an image output apparatus that outputs an image by using a plurality kinds of color material including a plurality of color materials of the same color but different in concentration, said method comprising the steps of:
 - providing a maximum total color material use amount which is determined by taking into account an adhesion characteristic of each of the plurality kinds of color material to a printing medium used when the image output apparatus outputs the patches;
 - determining, for each of patches, a combination of data for the plurality kinds of color material constituting the patch within a range of the maximum total color material use amount; and
 - determining a predetermined conversion relationship relating to the generation of color material data of the plurality kinds of color material including a plurality of color materials of the same color but different in concentration, on the basis of colorimetric values of the patches which are outputted based on the determined combinations of data for the plurality kinds of color material for the patches.

2. An image processing method as claimed in claim 1, further comprising the step of determining a defined total color material use amount within the range of maximum total color material use amount, and wherein said step of
5 determining the combination of data determines the combination of data for the plurality kinds of color material within the range of the defined total color material use amount.

10 3. An image processing method as claimed in claim 1, further comprising the step of obtaining information on determining of the defined total color material use amount, the information being previously set, and wherein said step of determining the defined total color material use amount
15 determines the defined total color material use amount in accordance with the information.

4. An image processing method as claimed in claim 1, wherein said step of determining the combination of data
20 determines the combination of data for the plurality kinds of color material including only the color material having higher concentration among the plurality of color materials of the same color but different in concentrations, and said step of determining the predetermined conversion
25 relationship separates the data for the color material having higher concentration to make data for the plurality of color materials of the same color but different in

concentrations so that the predetermined conversion relationship relating to the generation of the color material data for the plurality kinds of color material is determined.

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5. An image processing method as claimed in claim 4, wherein colors of the plurality kinds of color material are yellow, magenta, cyan and black, and the color materials of magenta and cyan are separated so that the predetermined conversion relationship for generating data for six kinds of color material is determined.

6. An image processing method as claimed in claim 1, wherein said step of determining the combination of color material data determines data for the plurality kinds of color material including all of the plurality of color materials of the same color but different in concentrations.

7. An image processing method as claimed in claim 4, wherein colors of the plurality kinds of color material are yellow, magenta, cyan, black, and light magenta having lower concentration than the magenta and light cyan having lower concentration than the cyan.

8. An image processing method as claimed in claim 4, wherein said step of determining the predetermined conversion relationship

determines ratio of each the color materials having the same color but different concentration on the basis of the combinations of color material data for the plurality kinds of color material, for each of the patches,

5 determines total use amount of each the color materials having the same color but different concentration, on the basis of the determined ratio of each the color materials having the same color, a total use amount of the plurality kinds of color material including all of the color materials
10 having the same color but different concentration and a use amount of color materials excluding the color materials having the same color but different concentration from the plurality kinds of color material; and

separates the color material data for the color
15 material having higher concentration to generate color material data for each of the color materials having the same color but different concentration, on the basis of the total use amount of each the color materials having the same color, the colorimetric value of the patches
20 outputted for the combinations of the color materials having the same color but different concentration.

9. An image processing method as claimed in claim 1, wherein the predetermined conversion relationship is
25 determined in accordance with a condition that a target color is a color having the highest saturation for each of six hues of yellow, magenta, cyan, red, green and blue.

10. An image processing method as claimed in claim 1, wherein the color material is ink.

5 11. An image processing method as claimed in claim 1, wherein the color material is toner.

12. An image processing method as claimed in claim 9, wherein the target colors in six hues of yellow, magenta, cyan, red, green and blue are colors changing in a L^*C^* plane from white to black through yellow, from white to black through magenta, from white to black through cyan, from white to black through red, from white to black through green, and from white to black through blue, respectively.

15 13. An image processing method as claimed in claim 12, wherein the target color is determined as a line in the L^*C^* plane which is formed by joining a target line that does not include black at all onto a target line that include black maximally by means of a continuous function from a predetermined point on a L^* .

14. An image processing apparatus for determining a conversion relationship by using patches, the conversion relationship relating to a generation of color material data for an image output apparatus that outputs an image by using a plurality kinds of color material including a

plurality of color materials of the same color but different in concentration, said apparatus comprising:

holding means for holding a maximum total color material use amount which is determined by taking into
5 account an adhesion characteristic of each of the plurality kinds of color material to a printing medium used when the image output apparatus outputs the patches;

combination determining means for, for each of patches, determining a combination of data for the plurality kinds
10 of color material constituting the patch within a range of the maximum total color material use amount; and

color separation means for determining a predetermined conversion relationship relating to the generation of color material data of the plurality kinds
15 of color material including a plurality of color materials of the same color but different in concentration, on the basis of colorimetric values of the patches which are outputted based on the determined combinations of data for the plurality kinds of color material for the patches.

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15. An image processing apparatus as claimed in claim 14, further comprising defined use amount determining means for determining a defined total color material use amount within the range of maximum total color material use amount,
25 and wherein said combination determining means determines the combination of data for the plurality kinds of color material within the range of the defined total color material

use amount.

16. An image processing apparatus as claimed in claim 15, further comprising means for obtaining information on determining of the defined total color material use amount, the information being previously set, and wherein said defined use amount determining means determines the defined total color material use amount in accordance with the information.

17. An image processing apparatus as claimed in claim 14, wherein said combination determining means determines the combination of data for the plurality kinds of color material including only the color material having higher concentration among the plurality of color materials of the same color but different in concentrations, and said color separation means separates the data for the color material having higher concentration to make data for the plurality of color materials of the same color but different in concentrations so that the predetermined conversion relationship relating to the generation of the color material data for the plurality kinds of color material is determined.

18. An image processing apparatus as claimed in claim 17, wherein colors of the plurality kinds of color material are yellow, magenta, cyan and black, and the color materials

of magenta and cyan are separated so that the predetermined conversion relationship for generating data for six kinds of color material is determined.

5 19. An image processing apparatus as claimed in claim 14, wherein said combination determining means determines data for the plurality kinds of color material including all of the plurality of color materials of the same color but different in concentrations.

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 20. An image processing apparatus as claimed in claim 19, wherein colors of the plurality kinds of color material are yellow, magenta, cyan, black, and light magenta having lower concentration than the magenta and light cyan having
15 lower concentration than the cyan.

 21. An image processing apparatus as claimed in claim 17, wherein said color separating means

 determines ratio of each the color materials having
20 the same color but different concentration on the basis of the combinations of color material data for the plurality kinds of color material, for each of the patches,

 determines total use amount of each the color materials having the same color but different concentration, on the
25 basis of the determined ratio of each the color materials having the same color, a total use amount of the plurality kinds of color material including all of the color materials

having the same color but different concentration and a use amount of color materials excluding the color materials having the same color but different concentration from the plurality kinds of color material; and

5 separates the color material data for the color material having higher concentration to generate color material data for each of the color materials having the same color but different concentration, on the basis of the total use amount of each the color materials having
10 the same color, the colorimetric value of the patches outputted for the combinations of the color materials having the same color but different concentration.

22. An image processing apparatus as claimed in claim
15 14, wherein the predetermined conversion relationship is determined in accordance with a condition that a target color is a color having the highest saturation for each of six hues of yellow, magenta, cyan, red, green and blue.

20 23. An image processing apparatus as claimed in claim 14, wherein the color material is ink.

24. An image processing apparatus as claimed in claim
25 14, wherein the color material is toner.

25 25. An image processing apparatus as claimed in claim 22, wherein the target colors in six hues of yellow, magenta,

cyan, red, green and blue are colors changing in a L^*C^* plane from white to black through yellow, from white to black through magenta, from white to black through cyan, from white to black through red, from white to black through green, and from white to black through blue, respectively.

26. An image processing apparatus as claimed in claim 25, wherein the target color is determined as a line in the L^*C^* plane which is formed by joining a target line that does not include black at all onto a target line that include black maximally by means of a continuous function from a predetermined point on a L^* .

27. A program read by a computer to make the computer execute an image processing for determining a conversion relationship by using patches, the conversion relationship relating to a generation of color material data for an image output apparatus that outputs an image by using a plurality kinds of color material including a plurality of color materials of the same color but different in concentration, said image processing comprising the steps of:

providing a maximum total color material use amount which is determined by taking into account an adhesion characteristic of each of the plurality kinds of color material to a printing medium used when the image output apparatus outputs the patches;

determining, for each of patches, a combination of

data for the plurality kinds of color material constituting the patch within a range of the maximum total color material use amount; and

determining a predetermined conversion relationship
5 relating to the generation of color material data of the plurality kinds of color material including a plurality of color materials of the same color but different in concentration, on the basis of colorimetric values of the patches which are outputted based on the determined
10 combinations of data for the plurality kinds of color material for the patches.

28. A program as claimed in claim 27, wherein said image processing further comprises the step of determining
15 a defined total color material use amount within the range of maximum total color material use amount, and said step of determining the combination of data determines the combination of data for the plurality kinds of color material within the range of the defined total color material use
20 amount.

29. A storage medium storing a program readably by a computer, the program making the computer execute an image processing for determining a conversion relationship by
25 using patches, the conversion relationship relating to a generation of color material data for an image output apparatus that outputs an image by using a plurality kinds

of color material including a plurality of color materials of the same color but different in concentration, said image processing comprising the steps of:

providing a maximum total color material use amount
5 which is determined by taking into account an adhesion characteristic of each of the plurality kinds of color material to a printing medium used when the image output apparatus outputs the patches;

determining, for each of patches, a combination of
10 data for the plurality kinds of color material constituting the patch within a range of the maximum total color material use amount; and

determining a predetermined conversion relationship relating to the generation of color material data of the
15 plurality kinds of color material including a plurality of color materials of the same color but different in concentration, on the basis of colorimetric values of the patches which are outputted based on the determined combinations of data for the plurality kinds of color
20 material for the patches.

30. A storage medium as claimed in claim 29, wherein said image processing further comprises the step of determining a defined total color material use amount within
25 the range of maximum total color material use amount, and said step of determining the combination of data determines the combination of data for the plurality kinds of color

material within the range of the defined total color material
use amount.